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EXAMINER	
HERNANDEZ, NELSON D	

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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	**Application No.** 10/774,603	**Applicant(s)** FOSSUM, ERIC R.	
	Examiner Nelson D. Hernández Hernández	**Art Unit** 2622	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *12 December 2008*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *26-28,30-35,37,38 and 40-48* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *26-28,30-35,37,38 and 40-48* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *10 February 2004* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)

2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.

4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .

5) ☐ Notice of Informal Patent Application

6) ☐ Other: _____.

DETAILED ACTION

Response to Amendment

1. The Examiner acknowledges the amended claims filed on November 7, 2008. **Claims 26, 33-35, 37, and 44** have been amended. **Claims 1-25, 29, 36, 39, and 49-56** have been cancelled.

Response to Arguments

2. Applicant's arguments with respect to **claims 26, 37, and 44** have been considered but are moot in view of the new grounds of rejection.

Claim Rejections - 35 USC § 103

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

4. Claims 26-28, 30-35, 37, 38, 40 and 44-48 are rejected under 35 U.S.C. 103(a) as being unpatentable over Denyer et al., WO 97/20434 in view of Adams, Jr. et al., US Patent 5,652,621.

5. The Examiner noted that **claims 26, 28, 30, 31, 33, 34, 37, 38, 44, and 48** are presented using the phrase "**configured to**" in the limitations.

It is noted by the Examiner that the term "**configured to**" is non-limiting and

therefore has not been given patentable weight during examination of the claims on their merits. Language that suggests or makes optional but does not require steps to be performed or does not limit a claim to a particular structure does not limit the scope of a claim or claim limitation. MPEP §2106.

The subject matter of a properly construed claim is defined by the terms that limit its scope. It is this subject matter that must be examined. As a general matter, the grammar and intended meaning of terms used in a claim will dictate whether the language limits the claim scope. <u>Language that suggests or makes optional but does not require steps to be performed or does not limit a claim to a particular structure does not limit the scope of a claim or claim limitation</u>. The following are examples of language that may raise a question as to the limiting effect of the language in a claim:

(A) statements of intended use or field of use,

(B) "adapted to" or "adapted for" clauses,

(C) "wherein" clauses, or

(D) "whereby" clauses.

This list of examples is not intended to be exhaustive. See also MPEP § 2111.04.

USPTO personnel are to give claims their broadest reasonable interpretation in light of the supporting disclosure. In re Morris, 127 F.3d 1048, 1054-55, 44 USPQ2d 1023, 1027-28 (Fed. Cir. 1997). Limitations appearing in the specification but not recited in the claim should not be read into the claim. E-Pass Techs., Inc. v. 3Com Corp., 343 F.3d 1364, 1369, 67 USPQ2d 1947, 1950 (Fed. Cir. 2003) <u>(claims must be interpreted "in</u>

view of the specification" without importing limitations from the specification into the claims unnecessarily). In re Prater, 415 F.2d 1393, 1404-05, 162 USPQ 541, 550- 551 (CCPA 1969). See also In re Zletz, 893 F.2d 319, 321-22, 13 USPQ2d 1320, 1322 (Fed. Cir. 1989) ("During patent examination the pending claims must be interpreted as broadly as their terms reasonably allow.... The reason is simply that during patent prosecution when claims can be amended, ambiguities should be recognized, scope and breadth of language explored, and clarification imposed.... An essential purpose of patent examination is to fashion claims that are precise, clear, correct, and unambiguous. Only in this way can uncertainties of claim scope be removed, as much as possible, during the administrative process.").

6. **Regarding claim 26**, Denyer et al. discloses an imager (*See figs. 3 and 4*), comprising:

a semiconductor substrate (*by teaching that the imaging array is located in a chip, Denyer et al. discloses a semiconductor substrate; see page 13, lines 1-22*);

an array of photosensitive sites (*Fig. 3 shows an array of pixels 2*) located on the substrate, the array including

a plurality of first photosensitive sites (*the array in Denyer et al. is divided into three kind of photosensitive sites (red, green and blue); see fig. 2; page 10, line 23 – page 12, line 32*), wherein each first photosensitive site is configured to measure the level of a first spectral component (*i.e. green light*) in light received by the respective first photosensitive site, and

a plurality of second photosensitive sites, wherein each second photosensitive site is configured to measure the level of a second spectral component in light received by the respective second site (*the array in Denyer et al. is divided into three kind of photosensitive sites (red, green and blue); see fig. 2; page 10, line 23 – page 12, line 32. This teaches at least a plurality of second photosensitive site configured to measure the level of a second spectral component in light received by the respective second site as claimed*), said second spectral component being different from said first spectral component (*the array in Denyer et al. is divided into three kind of photosensitive sites (red, green and blue); see fig. 2; page 10, line 23 – page 12, line 32. This teaches that the second spectral component being different from said first spectral component as claimed since each photosensitive site is receiving a single color spectral of the three colors that the full array receives*); and

an interpolator (*Denyer et al. discloses a processing unit (Fig. 4: 28) to perform color interpolation to the red, green and blue signals to form synchronous, parallel color channel signals for the video signal before being output to a display unit (Fig. 4: 30); page 11, line 33 – page 12, line 25*) located on the substrate (*Denyer et al. discloses that the processing unit can be incorporated in the same chip, where the imaging array is located; page 13, lines 1-22*) and configured to estimate the level of the different spectral components for each of the photosensitive sites based on an interpolation process using at least one level of spectral component from another site by performing interpolation configured to estimate the level of the first spectral component in the light received by at least one of the second photosensitive sites based on at least one

measurement of the first spectral component obtained respectively by at least one of the first photosensitive sites (*Denyer et al. discloses reconstructing the image colors of each pixels by performing interpolation to obtain an RGB value for each pixel location) (Page 10, line 23 – page 13, line 22*).

Although Denyer et al. discloses performing interpolation to reconstruct the image to produce a full RGB image, Denyer et al. does not explicitly disclose that estimating the level of the first spectral component in the light received by at least one of the second photosensitive sites based on at least one measurement of the first spectral component obtained respectively by at least one of the first photosensitive sites.

However, Adams Jr. et al. discloses a camera (*Fig. 1*) comprising:

a single imaging element (*Fig. 1: 12*) including

a plurality of first photosensitive sites (*Col. 2, line 47 – col. 3, line 9*), wherein each first photosensitive site is configured to measure the level of a first spectral component in light received by the respective first photosensitive site (*Adams Jr. et al. discloses that the camera further comprises a color filter array (CFA) covering the imaging element so that each of the photosites in the imaging element receives a color spectral out the three colors that the full photosensitive site array can receive; see col. 2, line 47 – col. 3, line 9*), and

a plurality of second photosensitive sites (*Col. 2, line 47 – col. 3, line 9*), wherein each second photosensitive site is configured to measure the level of a second spectral component in light received by the respective second site (*Adams Jr. et al.*

discloses that the camera further comprises a color filter array (CFA) covering the imaging element so that each of the photosites in the imaging element receives a color spectral out the three colors (green, red and blue) that the full photosensitive sites array can receive; see col. 2, line 47 – col. 3, line 9), said second spectral component being different from said first spectral component (*By teaching the use of CFA receiving green, red and blue colors, a single color for each of the photosites (Col. 2, line 47 – col. 3, line 9), Adams Jr. et al. discloses a second and third plurality of photosensitive sites configured to measure the level of a second and third spectral components in light received by the second and third photosensitive site*); and

an interpolator (*Digital Signal Processor 22 as shown in figs. 1 and 2*) configured to estimate the level of the first spectral component in the light received by at least one of the second photosensitive sites based on at least one measurement of the first spectral component obtained respectively by at least one of the first photosensitive sites (*Adams Jr. et al. discloses that for the missing green values in the red and blue colors in the received image (i.e. missing green values on red and blue photosensitive sites), color interpolation is performed using the green color photosensitive sites surrounding the target pixel (either red or blue photosensitive site) (Col. 4, line 37 – col. 5, line 20; col. 5, line 65 – col. 7, line 55). Therefore, if considering green, red and blue colors as first, second and third spectral components respectively, Adams Jr. et al. discloses estimating the level of the first spectral component (green) in the light received by at least one of the second photosensitive sites (red) based on at least one measurement*

of the first spectral component obtained respectively by at least one of the first photosensitive sites).

Therefore, taking the combined teaching of Denyer et al. in view of Adams Jr. et al. as a whole, after appreciating the concept of performing pixel interpolation to determine the missing color values of a particular pixel by using the color values of other pixels having the missing color on said particular pixel as taught in Adams Jr. et al., one of an ordinary skill in the art would find obvious at the time the invention was made to modify the imager in Denyer et al. to have the interpolator estimating the level of the first spectral component in the light received by at least one of the second photosensitive sites based on at least one measurement of the first spectral component obtained respectively by at least one of the first photosensitive sites. The motivation to do so would have been to improve the interpolation processing in the imager by accurately calculating the missing colors based on the particular position of the colors used for interpolation thus better representing the colors and have the output image to better resemble the original color of the object prior to its image capture.

7. **Regarding claim 27**, the combined teaching of Denyer et al. in view of Adams Jr. et al. as discussed and analyzed in claim 26 further teaches that the first spectral component is a primary color of light (*the array in Denyer et al. is divided into three kind of photosensitive sites (red, green and blue); see fig. 2; page 10, line 23 – page 12, line 32. Furthermore, Adams Jr. et al. discloses that the camera further comprises a color filter array (CFA) covering the imaging element so that each of the photosites in the*

imaging element receives a color spectral out the three colors (green, red and blue) that the full photosensitive sites array can receive; see col. 2, line 47 – col. 3, line 9)).

8. **Regarding claim 28**, the combined teaching of Denyer et al. in view of Adams Jr. et al. as discussed and analyzed in claim 26 further teaches that each second photosensitive site is configured to measure the level of a second spectral component in light received by the respective second photosensitive site (*taking in consideration green as a first spectral component for examining purposes, the second spectral components can be read as red. Denyer et al. discloses measuring green, red and blue colors as discussed in claim 26 above; also Adams Jr. et al. discloses measuring green, red and blue colors as discussed in claim 26), wherein a plurality of spectral components is measured*), and the interpolator is further configured to estimate the level of the second spectral component in the light received by at least one of the first photosensitive sites (*i.e. green color measured by photosensitive sites*) based on at least one measurement of the second spectral component (*i.e. red color measured by photosensitive sites*) obtained respectively by at least one of the second photosensitive sites (*As discussed and analyzed in claim 26, Adams Jr. et al. discloses that for the missing red values in the green and blue colors in the received image (i.e. missing red values on green and blue photosensitive sites), color interpolation is performed using the red color photosensitive sites surrounding the target pixel (either green or blue photosensitive site) (Col. 5, lines 37-63; col. 7, line 55 – col. 9, line 4). Therefore, if considering green, red and blue colors as first, second and third spectral components*

respectively, Adams Jr. et al. discloses estimating the level of the second spectral component (red color component) in the light received by at least one of the first photosensitive sites (i.e. photosensitive sites measuring green color) based on at least one measurement of the second spectral component (i.e. red color measured by photosensitive sites) obtained respectively by at least one of the second photosensitive sites). Grounds for rejecting claim 26 apply here.

9. **Regarding claim 30**, the combined teaching of Denyer et al. in view of Adams Jr. et al. as discussed and analyzed in claim 26 further teaches a plurality of third photosensitive sites (i.e. photosensitive sites measuring blue) (*taking in consideration green, red and blue as a first, second and third spectral component respectively for examining purposes. Denyer et al. discloses measuring green, red and blue colors as discussed in claim 26 above (this teaches a plurality of third photosensitive sites (i.e. photosensitive sites measuring blue color)); also Adams Jr. et al. discloses measuring green, red and blue colors as discussed in claim 26 (this teaches a plurality of third photosensitive sites (i.e. photosensitive sites measuring blue color)*), and the interpolator is further configured to estimate the level of the first spectral component (*green color component measured by the plurality of first photosensitive sites*) in the light received by at least one of the third photosensitive sites (*photosensitive sites measuring blue color*) based on at least one measurement of the first spectral component (*green color component*) obtained respectively by at least one of the first photosensitive sites (*Adams Jr. et al. discloses that for the missing green values in the

red and blue colors in the received image (i.e. missing green values on red and blue photosensitive sites), color interpolation is performed using the green color photosensitive sites surrounding the target pixel (either red or blue photosensitive site) (Col. 4, line 37 – col. 5, line 20; col. 5, line 65 – col. 7, line 55). Therefore, if considering green, red and blue colors as first, second and third spectral components respectively, Adams Jr. et al. discloses estimating the level of the first spectral component (green) in the light received by at least one of the third photosensitive sites (blue) based on at least one measurement of the first spectral component obtained respectively by at least one measurement of the first photosensitive sites), and to estimate the level of the second spectral component (*red color component measured by the second plurality of photosensitive sites*) in the light received by at least one of the third photosensitive sites (*photosensitive sites measuring blue color*) based on at least one measurement of the second spectral component (*red color component*) obtained respectively by at least one of the second photosensitive sites (*Adams Jr. et al. discloses that for the missing red values in the green and blue colors in the received image (i.e. missing red values on green (first) and blue (third) photosensitive sites), color interpolation is performed using the red color photosensitive sites surrounding the target pixel (either green or blue photosensitive site) (Col. 5, lines 37-63; col. 7, line 55 – col. 9, line 4). Therefore, if considering green, red and blue colors as first, second and third spectral components respectively, Adams Jr. et al. discloses estimating the level of the second spectral component (red) in the light received by at least one of the third photosensitive sites (blue) based on at least one measurement of the second spectral component obtained*

respectively by at least one of the second photosensitive sites. The same process is applied for estimating the level of the third spectral component (blue color component measured by the third photosensitive sites) in the light received by at the first photosensitive sites (measuring green color) and the second photosensitive sites (measuring red color) as discussed in Adams Jr. et al., col. 5, lines 37-63; col. 7, line 55 – col. 9, line 4). Grounds for rejecting claims 26 and 28 apply here.

10. **Regarding claim 31**, limitations have been discussed and analyzed in claims 28 and 30 above.

11. **Regarding claim 32**, limitations have been discussed and analyzed in claims 26-28 and 30 above.

12. **Regarding claim 33**, the combined teaching of Denyer et al. in view of Adams Jr. et al. as discussed and analyzed in claim 26 further teaches a line decoder (Denyer et al., 16 and 18 as shown in fig. 3) located in the substrate and having at least one serial output for transferring out at least one line of measured spectral components from the array during a read out operation (Denyer et al., page 11, line 1 - page 12, line 25); an A/D conversion element (fig. 4: 26) located in the substrate (Denyer et al. discloses that the A/D converter can be incorporated in the same chip where the imaging array is located; page 13, lines 1-22; page 12, lines 20-25) and configured to receive the at least one line of measured spectral components read out from the line decoder and output

the received measurements as digital values to the interpolator (Denyer et al., page 11, line 33 – page 12, line 25), and wherein the interpolator estimates the first spectral component levels in the second and third photosensitive sites, the second spectral component levels in the first and third photosensitive sites, and the third spectral component level in the first and second photosensitive sites based on the digital values received from the A/D conversion element (Denyer et al., page 11, line 33 – page 12, line 25). Grounds for rejecting claim 26 apply here.

13. **Regarding claim 34**, limitations have been discussed and analyzed in claim 33 above.

14. **Regarding claim 35**, the combined teaching of Denyer et al. in view of Adams Jr. et al. as discussed and analyzed in claim 26 further teaches that the at least one serial output of the line decoder (*Denyer et al., figs. 3: 16 and 3: 18; see also figs. 6: 45, wherein a read out means may comprise a plurality of shift registers*) transfers out several sequential lines of measured spectral components from the array during each read out operation (*Denyer et al., page 14, line 33 - page 15, line 27; using a plurality of shift registers would result in outputting a plurality of rows or an image block that would result in speeding up the readout process*). Grounds for rejecting claim 26 apply here.

15. **Regarding claim 37**, the combined teaching of Denyer et al. discloses an imager (*See figs. 3 and 4*), comprising:

a semiconductor substrate (*by teaching that the imaging array is located in a chip, Denyer et al. discloses a semiconductor substrate; see page 13, lines 1-22*);

a plurality of first photosensitive sites (*Fig. 3 shows an array of pixels 2*) located in the substrate, wherein each first photosensitive site is configured to measure the level of a first spectral component in light received by the respective first photosensitive site (*the array in Denyer et al. is divided into three kind of photosensitive sites (red, green and blue); see fig. 2; page 10, line 23 – page 12, line 32*);

a plurality of second photosensitive sites located in the substrate (*the array in Denyer et al. is divided into three kind of photosensitive sites (red, green and blue); see fig. 2; page 10, line 23 – page 12, line 32*), each second photosensitive site is configured to measure the level of a second spectral component in light received by the respective second photosensitive site (*taking in consideration green, red and blue as a first, second and third spectral components respectively for examining purposes, the second spectral components can be read as red. Denyer et al. discloses measuring red, green and blue colors, wherein a plurality of spectral components is measured*), said second spectral component being different from said first spectral component (*the array in Denyer et al. is divided into three kind of photosensitive sites (red, green and blue); see fig. 2; page 10, line 23 – page 12, line 32. This teaches that the second spectral component being different from said first spectral component as claimed since each photosensitive site is receiving a single color spectral of the three colors that the full array receives*); and

an interpolator (*Denyer et al. discloses a processing unit (Fig. 4: 28) to perform color interpolation to the red, green and blue signals to form synchronous, parallel color channel signals for the video signal before being output to a display unit (Fig. 4: 30); page 11, line 33 – page 12, line 25*) located on the substrate (*Denyer et al. discloses that the processing unit can be incorporated in the same chip, where the imaging array is located; page 13, lines 1-22*) and configured to receive digital data (*output from an A/D converter 26 as shown in fig. 4; page 11, line 33 – page 13, line 23*) representing the spectral component levels measured in the photosensitivity sites, and to estimate the level of the different spectral components for each of the photosensitive sites based on an interpolation process using at least one digitized measurement of spectral component from another site by performing interpolation configured to estimate the value of the first spectral component in the light received by at least one of the second photosensitive sites based on at least one digitized measurement of the first spectral component obtained respectively by at least one of the first photosensitive sites (*Denyer et al. discloses reconstructing the image colors of each pixels by performing interpolation to obtain an RGB value for each pixel location) (Page 10, line 23 – page 13, line 22*).

Although Denyer et al. discloses performing interpolation to reconstruct the image to produce a full RGB image, Denyer et al. does not explicitly disclose that estimating the level of the first spectral component in the light received by at least one of the second photosensitive sites based on at least one digitized measurement of the

first spectral component obtained respectively by at least one of the first photosensitive sites.

However, Adams Jr. et al. discloses a camera (*Fig. 1*) comprising:

a single imaging element (*Fig. 1: 12*) including

a plurality of first photosensitive sites (*Col. 2, line 47 – col. 3, line 9*), wherein each first photosensitive site is configured to measure the level of a first spectral component in light received by the respective first photosensitive site (*Adams Jr. et al. discloses that the camera further comprises a color filter array (CFA) covering the imaging element so that each of the photosites in the imaging element receives a color spectral out the three colors that the full photosensitive site array can receive; see col. 2, line 47 – col. 3, line 9*), and

a plurality of second photosensitive sites (*Col. 2, line 47 – col. 3, line 9*), wherein each second photosensitive site is configured to measure the level of a second spectral component in light received by the respective second site (*Adams Jr. et al. discloses that the camera further comprises a color filter array (CFA) covering the imaging element so that each of the photosites in the imaging element receives a color spectral out the three colors (green, red and blue) that the full photosensitive sites array can receive; see col. 2, line 47 – col. 3, line 9*), said second spectral component being different from said first spectral component (*By teaching the use of CFA receiving green, red and blue colors, a single color for each of the photosites (Col. 2, line 47 – col. 3, line 9), Adams Jr. et al. discloses a second and third plurality of photosensitive sites*

configured to measure the level of a second and third spectral components in light received by the second and third photosensitive site); and

an interpolator (*Digital Signal Processor 22 as shown in figs. 1 and 2*) configured to estimate the level of the first spectral component in the light received by at least one of the second photosensitive sites based on at least one measurement of the first spectral component obtained respectively by at least one of the first photosensitive sites (*Adams Jr. et al. discloses that for the missing green values in the red and blue colors in the received image (i.e. missing green values on red and blue photosensitive sites), color interpolation is performed using the green color photosensitive sites surrounding the target pixel (either red or blue photosensitive site) (Col. 4, line 37 – col. 5, line 20; col. 5, line 65 – col. 7, line 55). Therefore, if considering green, red and blue colors as first, second and third spectral components respectively, Adams Jr. et al. discloses estimating the level of the first spectral component (green) in the light received by at least one of the second photosensitive sites (red) based on at least one measurement of the first spectral component obtained respectively by at least one of the first photosensitive sites*).

Therefore, taking the combined teaching of Denyer et al. in view of Adams Jr. et al. as a whole, after appreciating the concept of performing pixel interpolation to determine the missing color values of a particular pixel by using the color values of other pixels having the missing color on said particular pixel as taught in Adams Jr. et al., one of an ordinary skill in the art would find obvious at the time the invention was made to modify the imager in Denyer et al. to have the interpolator estimating the level

of the first spectral component in the light received by at least one of the second photosensitive sites based on at least one digitized measurement of the first spectral component obtained respectively by at least one of the first photosensitive sites. The motivation to do so would have been to improve the interpolation processing in the imager by accurately calculating the missing colors based on the particular position of the colors used for interpolation thus better representing the colors and have the output image to better resemble the original color of the object prior to its image capture.

16. **Regarding claim 38**, limitations of claim 38 have been discussed and analyzed in claims 26, 28, 30 and 31.

17. **Regarding claim 40**, limitations have been discussed and analyzed in claims 26-28 and 30 above.

18. **Regarding claim 44**, Denyer et al. discloses an imaging device (*See figs. 3 and 4*), comprising:

a display (*Fig. 4: 30*) for displaying an image on an array of M x N pixels (*page 11, line 33 – page 12, line 25*); and

an imager (*Fig. 3: 1 and 4: 1*) which comprises

a substrate (*by teaching that the imaging array is located in a chip, Denyer et al. discloses a semiconductor substrate; see page 13, lines 1-22*),

an M x N array of photosensitive sites located on the substrate (*fig. 3 shows an M x N array of pixels* 2), the array including

a plurality of first photosensitive sites located in the substrate (*the array in Denyer et al. is divided into three kind of photosensitive sites (red, green and blue); see fig. 2; page 10, line 23 – page 12, line 32*), wherein each first photosensitive site is configured to measure the level of a first color (*i.e. green*) component in light received by the respective first photosensitive site, and

a plurality of second photosensitive sites (*the array in Denyer et al. is divided into three kind of photosensitive sites (red, green and blue); see fig. 2; page 10, line 23 – page 12, line 32) located in the substrate, wherein each second photosensitive site is configured to measure the level of a second color component (i.e. red color) in light received by the respective second photosensitive site (taking in consideration green, red and blue as a first, second and third spectral components for examining purposes, the second spectral components can be read as red. Denyer et al. discloses measuring red, green and blue colors as discussed in claim 26 above*), said second spectral component being different from said first spectral component (*the array in Denyer et al. is divided into three kind of photosensitive sites (red, green and blue); see fig. 2; page 10, line 23 – page 12, line 32. This teaches that the second spectral component being different from said first spectral component as claimed since each photosensitive site is receiving a single color spectral of the three colors that the full array receives*); and

an interpolator (*Denyer et al. discloses a processing unit (Fig. 4: 28) to perform color interpolation to the red, green and blue signals to form synchronous, parallel color channel signals for the video signal before being output to a display unit (Fig. 4: 30); page 11, line 33 – page 12, line 25*) located on the substrate (*Denyer et al. discloses that the processing unit can be incorporated in the same chip, where the imaging array is located; page 13, lines 1-22*) and configured to receive digitized color component values (*output from an A/D converter 26 as shown in fig. 4; page 11, line 33 – page 13, line 23*) corresponding to the measurements obtained in the first and second photosensitive sites, to estimate the level of the color component in the light received by at least one of the second photosensitive sites based on at least one digitized color component value obtained respectively from at least one of the other photosensitive sites, and to estimate the level of the second color component in the light received by at least one of the other photosensitive sites based on at least one digitized color component value obtained respectively from at least one of other photosensitive sites (*Denyer et al. discloses reconstructing the image colors of each pixels by performing interpolation to obtain an RGB value for each pixel location) (Page 10, line 23 – page 13, line 22*).

Although Denyer et al. discloses performing interpolation to the received digitized color components to reconstruct the image to produce a full RGB image, Denyer et al. does not explicitly disclose estimating the level of the first color component in the light received by at least one of the second photosensitive sites based on at least one digitized color component value obtained respectively from at least one of the first

photosensitive sites, estimating the level of the second color component in the light received by at least one of the first photosensitive sites based on at least one digitized color component value obtained respectively from at least one of the second photosensitive sites.

However, Adams Jr. et al. discloses a camera (*Fig. 1*) comprising:

a single imaging element (*Fig. 1: 12*) including

a plurality of first photosensitive sites (*Col. 2, line 47 – col. 3, line 9*), wherein each first photosensitive site is configured to measure the level of a first spectral component in light received by the respective first photosensitive site (*Adams Jr. et al. discloses that the camera further comprises a color filter array (CFA) covering the imaging element so that each of the photosites in the imaging element receives a color spectral out the three colors that the full photosensitive site array can receive; see col. 2, line 47 – col. 3, line 9*), and

a plurality of second photosensitive sites (*Col. 2, line 47 – col. 3, line 9*), wherein each second photosensitive site is configured to measure the level of a second spectral component in light received by the respective second site (*Adams Jr. et al. discloses that the camera further comprises a color filter array (CFA) covering the imaging element so that each of the photosites in the imaging element receives a color spectral out the three colors (green, red and blue) that the full photosensitive sites array can receive; see col. 2, line 47 – col. 3, line 9*), said second spectral component being different from said first spectral component (*By teaching the use of CFA receiving green, red and blue colors, a single color for each of the photosites (Col. 2, line 47 – col.*

3, line 9), Adams Jr. et al. discloses a second and third plurality of photosensitive sites configured to measure the level of a second and third spectral components in light received by the second and third photosensitive site); and

an interpolator (*Digital Signal Processor 22 as shown in figs. 1 and 2*) configured to estimate the level of the first spectral component in the light received by at least one of the second photosensitive sites based on at least one measurement of the first spectral component obtained respectively by at least one of the first photosensitive sites (*Adams Jr. et al. discloses that for the missing green values in the red and blue colors in the received image (i.e. missing green values on red and blue photosensitive sites), color interpolation is performed using the green color photosensitive sites surrounding the target pixel (either red or blue photosensitive site) (Col. 4, line 37 – col. 5, line 20; col. 5, line 65 – col. 7, line 55). Therefore, if considering green, red and blue colors as first, second and third spectral components respectively, Adams Jr. et al. discloses estimating the level of the first spectral component (green) in the light received by at least one of the second photosensitive sites (red) based on at least one measurement of the first spectral component obtained respectively by at least one of the first photosensitive sites). Adams Jr. et al. further discloses that for the missing red values in the green and blue colors in the received image (i.e. missing red values on green and blue photosensitive sites), color interpolation is performed using the red color photosensitive sites surrounding the target pixel (either green or blue photosensitive site) (Col. 5, lines 37-63; col. 7, line 55 – col. 9, line 4). Therefore, if considering green, red and blue colors as first, second and third spectral components respectively, Adams*

Jr. et al. discloses estimating the level of the second spectral component (red color component) in the light received by at least one of the first photosensitive sites (i.e. photosensitive sites measuring green color) based on at least one measurement of the second spectral component (i.e. red color measured by photosensitive sites) obtained respectively by at least one of the second photosensitive sites).

Therefore, taking the combined teaching of Denyer et al. in view of Adams Jr. et al. as a whole, after appreciating the concept of performing pixel interpolation to determine the missing color values of a particular pixel by using the color values of other pixels having the missing color on said particular pixel as taught in Adams Jr. et al., one of an ordinary skill in the art would find obvious at the time the invention was made to modify the imager in Denyer et al. to have the interpolator estimating the level of the first color component in the light received by at least one of the second photosensitive sites based on at least one digitized color component value obtained respectively from at least one of the first photosensitive sites, estimating the level of the second color component in the light received by at least one of the first photosensitive sites based on at least one digitized color component value obtained respectively from at least one of the second photosensitive sites. The motivation to do so would have been to improve the interpolation processing in the imager by accurately calculating the missing colors based on the particular position of the colors used for interpolation thus better representing the colors and have the output image to better resemble the original color of the object prior to its image capture.

19. **Regarding claim 45**, limitations have been discussed and analyzed in claim 44 above.

20. **Regarding claim 46**, limitations have been discussed and analyzed in claims 28, 30, 35 and 44 above.

21. **Regarding claim 47**, limitations have been discussed and analyzed in claims 28, 30 and 35 above.

22. **Regarding claim 48**, limitations have been discussed and analyzed in claims 28, 30, 31 and 44 above.

23. Claim 41 is rejected under 35 U.S.C. 103(a) as being unpatentable over Denyer et al., WO 97/20434 in view of Adams, Jr. et al., US Patent 5,652,621 and further in view of Acharya, US Patent 6,091,851.

24. **Regarding claim 41**, the combined teaching of Denyer et al. in view of Adams Jr. et al. fails to teach that the interpolator output twenty four bits of color data for each photosensitive site, with each color value being represented by eight bits.

However, Acharya teaches the concept of performing color recovery of imager captured by a camera (*Fig. 3: 330*) using a single sensor having a Bayer pattern color filter array in order to obtain a full resolution image from an object (*Fig. 3: 340*) being photographed, wherein the individual color components of each pixel area represented

by eight bits (*in order to represent a color intensity range from 0-255*) and the pixels of the image after interpolation is performed would have a total resolution of twenty four bits (*Col. 1, lines 4-48; col. 2, lines 40-52; col. 3, lines 16-41; col. 5, line 26 – col. 6, line 26; col. 9, lines 1-8*). Acharya also discloses that the interpolation method can be performed by hardware and firmware and that the interpolation method can be performed by the camera processor (*Fig. 3: 32*) (*Col. 10, lines 7-17*).

Therefore, taking the combined teaching of Denyer et al. in view of Adams Jr. et al. and further in view of Acharya as a whole, one of an ordinary skill in the art, after appreciating the advantages of the interpolation method of Acharya, would find obvious at the time the invention was made to modify the imager of Denyer et al. and Adams Jr. et al. by having the interpolator output twenty four bits of color data for each photosensitive site, with each color value being represented by eight bits. The motivation to do so would have been to have a desirable amount of color intensity values (256 color intensity values) for each color of each pixel in the image and to better represent luminance in recovering missing color components to have the output image to better resemble the original color of the object prior to its image capture.

25. Claims 42 and 43 are rejected under 35 U.S.C. 103(a) as being unpatentable over Denyer et al., WO 97/20434 in view of Adams, Jr. et al., US Patent 5,652,621 and further in view of Okada, US Patent 6,133,953.

26. **Regarding claim 42**, the combined teaching of Denyer et al. in view of Adams Jr. et al. fails to teach that the interpolator includes at least one serial register for storing

digital bit values representing the spectral component measurements from a photosensitive site being interpolated and the photosensitive sites neighboring the photosensitive site being interpolated.

However, Okada teaches a camera (*Fig. 1*) having a single imaging element (*Fig. 1: 10*) having a color separation circuit (*Fig. 1: 100*) having a two dimensional register (*Figs. 1: 30 and 3: 30*) connected to an interpolation processing circuit (*Figs. 1: 34 and 4: 34*), said two dimensional register receiving the digitized color values by an A/D converter (*Fig. 1: 48*) stored in a frame memory in order to input the color values from a block surrounding a particular pixel position where a color value is calculated by interpolation (*as shown in fig. 3, the registers (302, 304, 306, 308, 310, 312, 314, 316, 318, and 320) receive serially the color values of the pixels in a block as shown in fig. 2A; col. 7, line 16 – col. 8, line 38*). Okada further discloses performing pixel interpolation for a first photosensitive site configured to measure the level of a first spectral component in light received by the said first photosensitive site (*i.e. Cy 21 as shown in fig. 2A measuring Cyan*) to calculate a weight value of said first spectral component for a selected area; wherein to interpolate the color values for a pixel position, said interpolation digitally weights the values of the color being calculated using the color values stored in the two dimensional register (*having plural serial registers storing the colors values for four lines in a block*) based on the distance from the color values used for interpolation to a position of the area having the color weight calculated (*Col. 5, line 65 – col. 6, line 19; col. 6, lines 51-65; col. 7, line 16 – col. 8, line 38; col. 8, lines 59-65*).

Therefore, taking the combined teaching of Denyer et al. in view of Adams Jr. et al. and further in view of Okada as a whole, after appreciating the concept and advantages of having serial registers storing the color values for of pixels to be used for estimating the color value of a particular pixel area as taught in Okada, one of an ordinary skill in the art would find obvious at the time the invention was made to modify the imager in Denyer et al. and Adams Jr. et al. to have the interpolator including at least one serial register for storing digital bit values representing the spectral component measurements from a photosensitive site being interpolated and the photosensitive sites neighboring the photosensitive site being interpolated and having the interpolator estimating a spectral component level for a photosensitive site, by digitally weighting the values of the spectral component being estimated, as measured by the photosensitive sites providing the measurements and which are currently stored in the at least one serial register, based on the distances of the photosensitive sites providing the measurements from the photosensitive site for which the spectral component is being estimated. The motivation to do so would have been to improve the interpolation processing in the imager by serially storing the color values in the registers so that said color values can be access in a parallel by the interpolation circuit thus receiving the values needed for calculation at the same time.

27. **Regarding claim 43**, limitations have been discussed and analyzed in claim 42 above.

Conclusion

28. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Contact

29. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Nelson D. Hernández Hernández whose telephone number is (571)272-7311. The examiner can normally be reached on 9:00 A.M. to 5:30 P.M.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Lin Ye can be reached on (571) 272-7372. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

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Examiner
Art Unit 2622

NDHH
January 22, 2009

/Lin Ye/
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